REMARKS

Acknowledgement is made of the Examiner's objection to Figure 1. Enclosed herewith for the Examiner's approval is a corrected Figure 1. Favorable consideration is respectfully solicited.

The abstract and specification have been amended in order to correct grammatical and idiomatic errors contained therein. No new matter has been added. The claims have been amended in order to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claim 4 has been changed from an independent claim to a claim dependent on Claim 1. No new matter has been added. It is respectfully submitted that the currently presented claims are clearly patentably distinguishable over the prior art cited by the Examiner.

Claims 4-8 have been rejected under 35 USC 102(b) as being anticipated by Masuda et al. Claims 1-3 have been rejected under 35 USC 103(a) as being unpatentable over Takeda. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

Acknowledgement is made of the Examiner's objection to the disclosure for not containing headings as indicated in the office action. The Examiner is informed that the indicated headings are proposed and not mandatory. That is, it is not required that Applicants use the identical headings suggested by the Examiner or in the MPEP. However, if the Examiner so desires, he can change the headings of the present invention by Examiner's amendment.

The presently claimed invention is directed to a sheath-core composite conductive fiber comprising a sheath component made of a fiber-forming polymer containing conductive carbon black, characterized in that a core component and the sheath component satisfies the relationship $r/R \leq 0.03$, where R is a radius of an inscribed circle of the sheath component and r is the distance between the centers of two inscribed circles of

the core and sheath components in a cross section of the fiber.

As discussed in the present specification, composite fibers made by coating a conductive component containing conductive particles with a non-conductive component are well known in the art as conductive fibers. However, it is difficult to measure the electrical resistance of these fibers in that these measurements are typically taken by contacting an electrode at two positions on the surface of a textile product but the measured resistance value is typically higher in the case of a conductive yarn incorporated with a textile product not having a surface conductive layer because the conductive component does not contact with an electrode.

It has been proposed to overcome this problem by coating the surface of a product with a metal such as titanium oxide or cuprous iodide. However, the resulting product has insufficient washing durability and exhibits a high conductivity at initial stage but, since the metal peels off during washing, the conductive performance lowers thereafter.

It has also been proposed to form a sheath-core composite fiber comprising a sheath made of a conductive layer containing carbon black incorporated therein. However, this product was not felt to be suitable for practical use because the formation of a sheath-core composite fiber was not easily performed due to the presence of the carbon black dramatically lowering the spinability of a thermoplastic resin and the core portion and the sheath portion differing in thermal fluidity, thereby making the spinability much worse. Additionally, there was a problem in that the operability thereof was also lowered in post-processes, such as a drawing process and weaving/knitting because the sheath-core composite shape partially becomes un-uniform for the same reason.

The presently claimed invention has been arrived at in order to overcome the problems discussed above. That is, the present invention was arrived at after discovering that the coherency and waviness of the conductive fiber was improved

and the passableness thereof in a post-process was remarkably improved by controlling the center of an inscribed circle of a sheath component in a cross-section of a sheath-core composite fiber obtained by a melt-spinning process within a specified range. Additionally, in another embodiment of the present invention, the sheath component has a carbon black content of from 10 to 50 wt.% and the core component can be made of a polyester containing ethylene terephthalate as a main component and a sheath component made of a mixture of a copolyester wherein ethylene terephthalate accounts for 10 to 90 mol% of the constituent units thereof and carbon black. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

The Masuda et al reference discloses an electrically conductive sheath-core conjugate polyester monofilament formed from an electrically conductive copolyester as a sheath component and an aromatic polyester as a core component. In this reference, the copolyester is formed from a butylene terephthalate unit and/or a butylene isophthalate unit and an aliphatic dicarboxylic acid dibutylester. Due to the mechanical characteristics of these compounds, a high temperature for melting the butylene terephthalate unit has to be chosen. This high temperature causes polymer deterioration and contamination in the lead hole of the flow channel of the conductive polymer. Due to this, it will be difficult to make a sheath-core composite conductive fiber having the claimed relationship between the core component and the sheath component. In contrast thereto, in the present invention, the sheath-core composite conductive fiber is made of ethylene terephthalate and therefore has mechanical properties which enable it to form a sheath-core component satisfying the claimed relationship.

Additionally, in Masuda et al, the high conductivity carbon black content is only from 4-15% due to the high temperature causing polymer deterioration and contamination of the lead hole and the flow channel of the conductive polymer.

In contrast thereto, since the contamination problem does not arise in the present invention, the carbon black content of the sheath component can be as high as 50% by weight. Therefore, it is respectfully submitted that the presently claimed invention is clearly patentably distinguishable over this reference.

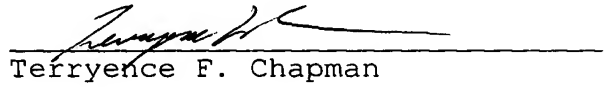
The Takeda reference discloses a highly electrically conductive composite filament of the sheath-core type comprising core and sheath layers of an electrically non-conductive thermoplastic polymer and a middle layer of electrically conductive thermoplastic polymer containing carbon black between the core and sheath wherein the sheath partially surrounds the outer periphery of the middle layer. Takeda is patentably distinguishable from the presently claimed invention in that this reference requires that a conductive middle layer and a nonconductive sheath layer be provided on the core. In contrast thereto, the present invention does not require a middle layer so the outer sheath layer is electrically conductive as opposed to the nonconductive sheath layer of Takeda. Additionally, the present invention requires that the sheath-core component satisfy the relationship $r/R \leq 0.03$ because the sheath component utilizes a mixture of a copolyester containing ethylene terephthalate in an amount of from 10-90 mol% and carbon black. The Takeda reference has no recognization with respect to the importance of the claimed relationship between "r" and "R".

Although the Examiner has not made a showing of prima facie obviousness under 35 USC 103, objective evidence is of record in the present application which further establishes the unobviousness of the presently claimed invention. As shown in Table 1-1 on pages 20 and 21 of the present specification, the Examples of the present invention meeting the claimed requirements with respect to the relationship between "r" and "R" produced a superior fiber as compared to the fibers produced by the Comparative Examples which were

identical in every fashion except for meeting the claimed relationship. That is, Example 1-1 should be compared with Comparative Example 1-1, Example 1-2 compared with Comparative Example 1-2, Example 1-3 compared with Comparative Example 1-3 and Example 1-4 compared with Comparative Example 1-4. The fibers of the present invention clearly have superior properties with respect to process passableness as compared with the fibers prepared by the Comparative Examples. Similar results are also shown in Table 2-1 on page 24 of the present specification. Therefore, although the Examiner has not made a showing of prima facie obviousness under 35 USC 103, it is respectfully submitted that objective evidence is of record which is more than sufficient to rebut any rejection under 35 USC 103.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,



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CORE-SHEATH COMPOSITE CONDUCTIVE FIBER

ABSTRACT

~~The present invention is a~~A sheath-core composite conductive fiber ~~comprising~~having a sheath component made of a fiber-forming polymer containing conductive carbon black, is characterized in that, with respect to an inscribed circle of a core component and an inscribed circle of a sheath component in a cross section of the fiber, a radius (R) of the inscribed circle of the sheath component and a distance (r) between the centers of two inscribed circles satisfy a specific relationship, and a sheath-core composite conductive fiber ~~comprising~~having: a core component made of a polyester containing ethylene terephthalate as a main component, and a sheath component made of a mixture of a copolyester wherein ethylene terephthalate accounts for 10 to 90 mol% of constituent units thereof and carbon black. The conductive fiber ~~of the present invention~~can be used alone or in combination with other fibers in various applications, e.g., special working clothes such as dust-free clothes and interiors such as carpets.